

ABRAMS (A.)

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THE PNEUMATIC CABINET.

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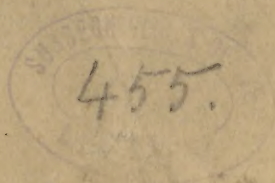
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*Read before the San Francisco County Medical Society,
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REPORT OF ONE HUNDRED AND SIXTY-THREE CASES TREATED WITH THE PNEUMATIC CABINET.

By ALBERT ABRAMS, M. D., San Francisco, Cal.

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At a previous meeting of this Society, I read a paper on "The Pneumatic Cabinet and its Use in the Treatment of Pulmonary Diseases." My experience with the cabinet at that time was limited, and I then promised at a future meeting to present a more extended report. I believe, that after using the cabinet in more than three hundred cases, my experience has become sufficiently matured to justify the fulfillment of my promise. My observations will be limited to 163 cases only, of which careful records have been made. To eliminate a prevalent misconception of the cabinet and its uses, the interpolation of a few remarks on this subject will, I hope, be permissible. The main principle involved in the pneumatic cabinet is this: that the air which the patient breathes is of a different tension from that surrounding the body and which is properly called the principle of pneumatic differentiation. As employed ordinarily the patient is seated in a rarefied atmosphere and breathes the outside air which is relatively compressed air. The effect of this procedure is to remove pressure from the body generally, to expand the chest walls and to increase the capacity of the lungs, while the inspiration of the outside air which is relatively dense dilates the bronchi and vesicles. The cabinet is provided with an ingenious mechanism which permits the operator at will not only to rarefy the air within the cabinet but to condense it to a given degree or alternately to rarefy and condense it. Provision is also made with this apparatus for the introduction of a medicated spray or vapor for topical medication of the passages. The main objects attained with the cabinet, are: pulmonary calisthenics, topical medication and stimulated arterial

circulation. The diseases, with their number treated by me, with the cabinet, may be grouped as follows:

DISEASE.	NO. OF CASES.
Pulmonary tuberculosis.....	56
Asthma.....	17
Bronchitis	24
Emphysema.....	11
Pulmonary atelectasis.....	6
Pneumonia (unresolved).....	9
Ankylosis of the lung.....	12
Pleuritic exudation.....	3
Bronchiectasis.....	2
Abscess of the lung.....	1
Syphilis of the lung.....	1
Paralytic thorax.....	16
Disturbances of the pulmonary circulation..	3
Anæmia.....	2
Total.....	163

Improvement was noted in all the cases of *pulmonary tuberculosis* with the exception of 4 cases, where the treatment was voluntarily suspended by the patients after a few sittings. Improvement was manifested by increase of appetite and weight and the disappearance of night sweats, fever and dyspnoea. Improvement followed the third or fourth treatment, inasmuch as this number of seances was necessary to accustom the patients to the use of the apparatus. The sittings were limited from 2 to 15 minutes and were conducted daily, every other day, or three times a week. The patients, as a rule, breathed relatively compressed air while surrounded by a rarefied atmosphere. No ill results attended the cabinet treatment other than attacks of syncope in two cases. Cough and expectoration, contrary to the observation of other writers, were in many cases uninfluenced and in a few cases increased. This could be explained by the increased volume of tidal air opening contracted tubes and atelectatic alveoli, thus establishing free communication of the disintegrated areas with the bronchi. A similar explanation will account for the singular fact noted in a few cases where tubercle bacilli could not be found in the sputa, was the readiness of their detection after a few sittings of the cabinet treatment. This fact may be of some importance in the diagnosis of doubtful cases. The disappearance of fever and night sweats I attributed to facilitated expectoration. Stagnation of sputa results in the development and absorption of

ptomaines which are the probable cause of fever and night sweats. Perhaps many of you have made the observation, that narcotics administered to allay the cough of phthisical patients by retarding expectoration increase the fever and night sweats. Improvement in nutrition observed in many of my patients was evidently due in part to the action of the cabinet in facilitating expectoration. It is a fact that vomiting frequently attends severe paroxysms of coughing, and if these paroxysms are mitigated, vomiting ceases. In a few cases, contrary to expectation, mensuration showed no increase in the diameters of the chest, a fact which could be explained by a premature ossification of the costal cartilages; a condition frequently present in hereditary phthisis. Hæmoptysis directly attributable to the cabinet treatment was not observed in any case. The effect of compressed air is to compress the pulmonary blood vessels and thus exsanguinate the lung tissue. Percussion in a large number of cases showed resonance superseding dullness, and auscultation showed bronchial to be replaced by "undetermined respiration." The development of these signs even in the absence of marked improvement in the subjective symptoms was supposed to be due to an emphysematous condition of the lungs adjacent to the diseased structures. The artificial emphysema thus developed must be looked upon as rather favorable, for it increases the respiratory area which has already been impaired by parts of the lung which are collapsed and functionless. The extraordinary relief from dyspnoea in phthisical patients after the cabinet treatment is evidently due to the artificially developed compensatory emphysema. When we take into account the facts so frequently observed by the pathologist and clinicist, that compensatory emphysema co-exists with pulmonary tuberculosis, and that the presence of an emphysema of the lungs often excludes tuberculosis, then the development of the former is to be encouraged even though a lesser is substituted for a greater evil. While I have employed sprays and vapors of various antiseptic substances for topical medication in connection with the cabinet, I am not enthusiastic regarding their therapeutical value. I regard the pneumatic cabinet as the most efficient apparatus at our command for the conveyance of atomized fluids into the respiratory tract, and while I am not credulous enough to suppose that the inhaled antiseptics produce actual death of the bacilli present, they might prove at least prejudicial to the vital activity of the organisms. I am of the opinion that many

of the good effects achieved by the cabinet are due to the mechanical action of the instrument. The cabinet properly used effects aerial lavage of the respiratory apparatus and expels the residual air which always stagnates in the remote part of the lungs. Air is a most thorough scavenger of the respiratory apparatus. The air impinging on every part of the lung is an adequate guarantee of absolute disinfection. The lungs can only remain in a physiological condition provided they receive the necessary aerial nutrition. In the development of the antiseptic treatment, filth was recognized as the carrier of diseased germs and the object of treatment was the destruction of the germs by cleanliness and antiseptics. The modern surgeon does not depend so much on the addition of antiseptics to the water which he uses for wound treatment as he does on absolute cleanliness, thus rendering the antiseptic subservient to the aseptic treatment. So it is with the treatment of pulmonary tuberculosis. Climate is to-day recognized as the most effective treatment of phthisis. The consumptive may find as much relief in the cold dry air of mountainous countries as in the mild atmosphere of Southern California. It is not the climate nor the altitude which determines results, but the purity of the air and its freedom from dust and other noxious elements. Among the many reasons adduced why tuberculosis more frequently attacks the apices than any other part of the lung, one above all others is entitled to consideration, viz: that the apices move less on respiration than the other parts of the lung, or expressed in more explicit language, the air supply to the apices is not only small in volume but furnished less often than are other pulmonary districts; and inasmuch as we contend the aerial to be the equivalent of vascular nutrition, the apices represent the points of least resistance. When we learn that the tidal or breathing volume of air amounts to only 25 cubic inches, and that the complemental air, which is the air taken into the lungs by forced breathing, in addition to the tidal volume, amounts to about 100 cubic inches, and knowing that the average respiratory capacity of an adult is about 225 cubic inches, the conclusion is evident, that even in a state of health the lungs are imperfectly aerated. Any prolonged quiescence of a part destined by nature for activity serves as a favorable nidus for the invasion of disease. The recognition of the fact that in health certain parts of the lung may be in a condition of *physiological atelectasis* has been of great value to me in the examinations of

the lungs. Percussion of the apices as well as the posterior surface of the lungs in many individuals often yields a dull percussion sound, which disappears after repeated deep inspirations. Such dullness is often physiological and is due to pulmonary atelectasis, but unless the physician is aware of this fact, the dullness may be interpreted to be of pathological origin. Of my 56 cases of tuberculosis, only 25 are available for statistical consideration, the other cases having been under treatment too short a time. The average duration of treatment in the 25 cases was about six weeks, and the average number of sittings about 20. Of this number four were cured or 16 per cent, twelve or 48 per cent were nearly cured, seven or 28 per cent were improved and two cases were uninfluenced. The cured cases refer to individuals who remained well as far as known up to the time of writing, 3, 2½, 2 and 1 year respectively after their discharge. The following case, one of many, sent to me by Dr. W. R. Cluness, late President of the California State Medical Society, will illustrate the usual course pursued by the disease in an improved patient:

L. S., age 32. No history of heredity. Symptoms: cough, expectoration, dyspnoea, emaciation, night sweats, anorexia. Objective examination: dullness of right apex anteriorly and posteriorly; mucous rales and bronchial breathing over the same apex. Weight 140 pounds; chest measurement, full inspiration, 33½ inches; forced expiration, 31½ inches. The sputa contain tubercle bacilli in large numbers. Diagnosis: bacillary phthisis. Treatment was begun January 31st, 1889. The cabinet treatment was supplemented by the use of morrhuel and creasote.

Feb. 4th, 1889.—Patient feels better and expectoration is diminished. Feb. 9th.—No more dyspnoea on exertion; sleep improved and appetite better; no night sweats.

Feb. 15th.—Chest measurements, full inspiration, 35½ inches; forced expiration, 32½ inches; weight, 145 pounds.

Feb. 20th.—Suffers no inconvenience and wishes to suspend treatment. Continues to increase in weight.

Feb. 24th.—Sputum contains no bacilli and patient discharged.

While attending the last meeting of the State Society in Sacramento I was approached by the individual whose case is here recorded, who informed me that he was perfectly well, which was about two years and a half after his discharge.

My results were particularly disappointing in two cases of incipient pulmonary tuberculosis which were in every way suitable for treatment. While both cases were improved at the time treatment was discontinued, the further course of the disease was very unsatisfactory.

The results with the 17 cases of *asthma* were: nine cured, four improved and four unimproved. The cured and the improved cases referred to individuals who had paroxysms of dyspnoea resembling asthma, which were caused by chronic bronchitis and emphysema. The results in these cases were remarkable. Three of the cases resisted all other methods of treatment and were of many years duration. The dyspnoeic paroxysms being dependent on the bronchitis or emphysema the relief of these caused the paroxysm to cease. The unimproved cases were true nervous asthma on which the cabinet seemed to be without influence. The cabinet was, however, of some value in relieving the severity and duration of the paroxysms. In asthma there is a spasm of the unstriated muscular fibres of the bronchial tubes, preventing the free exit of air, hence the dyspnoea is particularly expiratory in character. The use of compressed air during expiration facilitates this act and thus affords relief. Owing to the spasm of the bronchial muscular fibres, which occur in asthmatic individuals even in the intervals of the paroxysms when relatively compressed air enters the air passage, the air as well as the medicated spray fail to reach the alveoli of the lungs. I find that the inhalation of *nitrite of amyl* or the addition of the latter to the medicated solution is of decided value in overcoming these obstacles; in fact, the addition of *amyl nitrite* to all solutions intended for atomization is of decided value.

The 24 cases of *bronchitis* were classified as follows: Acute, 10; chronic, 13; capillary, 1. All the cases of acute bronchitis were completely cured after two, three or four sittings. Of the chronic cases, 9 were recorded as cured, 2 as improved and 2 unimproved. The latter, were cases of many years duration. Among the chronic cases, were three which on auscultation showed evidence of catarrh of the apices, which for the absence of tubercle bacilli in the sputum would be diagnosed as cases of incipient tuberculosis. In bronchitis the cabinet is a specific. Decided benefit was noted in the cases of bronchitis from the inhalation of a spray of iodide of potash solution. One case of *capillary bronchitis* is noted, which is of special interest. The patient, an elderly gentleman, was bedridden; his

case was urgent and the usual treatment was without effect on the increasing dyspnoea and cyanosis; in his enfeebled condition he was conveyed to my office and the cabinet was used. The first sitting was marvelous in its effect, and after ten further sittings the patient was cured. This case was instructive; it emphasized the necessity of making more general use of compressed air at the bedside. In cases of broncho-pneumonia, capillary bronchitis and other affections of the respiratory apparatus, where dyspnoea becomes urgent and the case hopeless, recourse is had as a *dernier ressort* to inhalation of oxygen. No procedure seems more illogical. Even if the oxygen reaches the pulmonary alveoli, which is highly problematical, it is nothing more than a palliative measure. No opportunity has lately arisen for me to use compressed air at the bedside, but to meet such an emergency I have put together a simple transportable compressed air apparatus with a three-way valve and mouth-piece. Such an apparatus is inexpensive and easily constructed.

None of my cases of *emphysema* were noted as cured, but the relief experienced in nearly all the cases was very great. In *emphysema*, the difficulty in breathing is at the time of expiration. To treat such cases rationally, the pneumatic cabinet permits the operator at will either to rarefy the air within the cabinet, or to condense it to a given degree, or alternately to rarefy or condense it. In *emphysema*, the air within the cabinet is condensed with the act of exhalation. The treatment of co-existing bronchial catarrh is imperative in nearly every case of *emphysema*, but if we cause the patients to inhale compressed air, while we benefit the bronchitis we increase the *emphysema*. This difficulty I have sought to obviate, by encircling the chest with a rubber bandage, securing thereby what is most needed, difficult inspiration and facilitated expiration.

Six cases of *pulmonary atelectasis* are recorded; three were cured, one improved and two unaffected. They were nearly all cases of atelectasis from compression. If the compression causing atelectasis is kept up too long, certain histological changes in the lung occur rendering the latter impermeable, even after the pressure is removed. Such cases would receive no benefit from any treatment and it is presumed that the unaffected cases noted were of this kind. The lower lobes of the lungs are very frequently implicated in atelectasis from compression. Taking advantage of this fact, I concentrated the action of compressed air on the affected portions of the lung by encircling the upper part of the chest with a rubber bandage.

There were nine cases of *unresolved pneumonia*; five were cured and the duration of treatment in the other four cases was too short to expect results. Even for months after apparent resolution of a pneumonia, functional disturbances of the affected lung can be demonstrated by the usual physical signs, comparisons being made with the unaffected side. Delayed resolution in pneumonia is relatively frequent in a cachectic subject in whom symptoms of heart insufficiency exist. The slow absorption of the hepatization in these cases renders the lung a suitable field for the development of tuberculosis, gangrene, abscess and retraction.

Ankylosis of the lung. This term, referred to in a previous paper, signifies the formation of pleuritic adhesions from a previous pleuritis approximating the visceral together with the lung to the parietal layer of the pleura, a condition somewhat analogous to that which occurs in joints, an ankylosis. If my observations at the post-mortem table are of any significance, I would say, that pleuritic adhesions exist in nearly every adult. Their presence leads to a group of symptoms of which pain and dyspnoea, chiefly on exertion, are prominent. The objective examination in these cases is not encouraging, the movements of the affected side are retarded during respiration and auscultation may show diminished or altered respiratory murmurs according to the laxity or density of the adhesions. The relief afforded in these cases was excellent and immediate. Such expressions as, "I couldn't take such a deep breath for months," or "I feel this side move which it never did before" are frequent.

Three cases of *pleuritic exudation* are recorded; of these two were sero-fibrinous exudations returning after paracentesis and the other empyema with a fistulous opening occurring in a physician. The former cases were cured. The latter case was very much improved; the dyspnoea of the patient due to pulmonary atelectasis was relieved and the purulent discharge became diminished and watery.

Two presumable cases of *bronchiectasis* are noted as improved. These cases were interesting from the fact that the intensely foetid odor of the sputum was completely controlled after other means had failed. This result I attribute not only to the mechanical dislodgment of the stagnated sputa but to the action of medicated sprays.

In the cases of *abscess and syphilis of the lung*, no results are recorded.

The cases showing *paralytic thorax* were 16 in number. They were individuals with a family history of phthisis. Such individuals bear the stigma of heredity in the peculiar configuration of their thorax. They are usually subject to "taking cold," are anæmic and emaciated. As a rule these cases showed increased chest measurements and improved bodily nutrition. I know of no means better calculated to improve a poorly developed pulmonary apparatus than the pneumatic cabinet.

Three cases of *disturbances of circulation* are recorded, consecutive to valvular lesions of the heart. The chief symptoms demanding treatment were dyspnoea, cyanosis and cardiac palpitation. The inhalation of compressed air in these cases resulted in an immediate amelioration of the symptoms. Compressed air exsanguinates the lungs and does all the work of disturbed compensation. One of the cases, a case of mitral insufficiency, seen in consultation with Dr. A. W. Perry, developed, after treatment relieved many of his symptoms, hemiplegia due to a cerebral embolus. It is difficult to say whether, in this case, the cabinet was responsible for the embolus, but this much is true, however, that extreme caution must be exercised with all patients undergoing the cabinet treatment who show heart lesions.

The remaining two cases of *anæmia* were introduced into the cabinet for experimental purposes only. The chemical effects secured by compressed air are: increase of the appetite, muscular power and bodily weight, which are caused by the increased introduction of oxygen into the system, on the principle that the inspired volume of compressed air contains more oxygen than a like volume of rarefied air. Anæmia is a frequent manifestation of latent tuberculosis and a prominent symptom in individuals with poorly developed chests and affections of the lung; and it is not unreasonable to suppose that diminished respiratory activity may be one of the etiological factors in anæmia. My student, Mr. Johannsen, has, at my suggestion, made blood examinations of anæmic patients treated only by means of the pneumatic cabinet, and though his results are far from complete they are encouraging.

I will say in conclusion that I have presented a trustworthy report of my cases, and while my results have not always been satisfactory, I consider the cabinet, nevertheless, not only a valuable, but an indispensable, instrument in the treatment of many diseases of the respiratory apparatus.

